

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003727

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02M21/02 F02M51/06 F02M61/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 924 674 A (FUCHS HEINZ ET AL) 20 July 1999 (1999-07-20) abstract column 4, line 8 - column 4, line 17; figure 1	1-15
X	EP 0 026 060 A (LUCAS IND PLC) 1 April 1981 (1981-04-01) page 4, line 18 - page 4, line 23; figure 1	1-15
X	PATENT ABSTRACTS OF JAPAN vol. 013, no. 593 (M-914), 27 December 1989 (1989-12-27) & JP 01 249960 A (JAPAN ELECTRON CONTROL SYST CO LTD), 5 October 1989 (1989-10-05) abstract	1-15

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the International filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the International filing date but later than the priority date claimed

- "T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the International search

12 November 2004

Date of mailing of the International search report

24.11.2004

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003727

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 88/04727 A (LUCAS IND PLC) 30 June 1988 (1988-06-30) page 5, line 4 - page 5, line 10; figure 2 -----	1-15
X	WO 99/18345 A (CAMPBELL BILL ROSS ;GAS INJECTION TECHNOLOGIES PTY (AU)) 15 April 1999 (1999-04-15) abstract; figure 1 -----	1-15
X	EP 1 231 378 A (DELPHI TECH INC). 14 August 2002 (2002-08-14) column 3, line 48 - column 3, line 49; figure 1 -----	1-15
X	GB 2 178 483 A (LUCAS IND PLC) 11 February 1987 (1987-02-11) page 1, line 84 - page 1, line 86; figures 2,3 -----	1-15
X	US 4 156 506 A (LOCKE ALAN W ET AL) 29 May 1979 (1979-05-29) column 3, line 18 - column 3, line 20; figure 6 -----	1-15
X	EP 0 491 404 A (JAPAN ELECTRONIC CONTROL SYST) 24 June 1992 (1992-06-24) figure 2 -----	1-15
X	EP 1 114 929 A (RENAULT) 11 July 2001 (2001-07-11) figure 1 -----	1-15
X	US 6 311 901 B1 (HALL BRYAN ET AL) 6 November 2001 (2001-11-06) figure 5 -----	16-20
X	US 5 685 485 A (KAPPEL ANDREAS ET AL) 11 November 1997 (1997-11-11) column 3, line 65 - column 4, line 4; figure 2 -----	16-20
X	US 2002/074431 A1 (REN WEI-MIN ET AL) 20 June 2002 (2002-06-20) page 3, paragraph 28; figure 2 -----	16-20
P, X	EP 1 398 497 A (DENSO CORP) 17 March 2004 (2004-03-17) figures 2,5 -----	16-20
X	US 6 422 198 B1 (FOURNIER STEPHANE ET AL) 23 July 2002 (2002-07-23) column 7, line 13 - column 7, line 15; figures 3,7 -----	16-20
		-/-

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003727

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/030124 A1 (IMOEL WILLIAM JAMES) 14 March 2002 (2002-03-14) page 3, paragraphs 34,36,40; figure 5 -----	16-20
P, X	EP 1 375 903 A (SIEMENS VDO AUTOMOTIVE CORP) 2 January 2004 (2004-01-02) figures 2a,2b -----	16,17, 19,20

INTERNATIONAL SEARCH REPORTInternational application No.
PCT/EP2004/003727**Box II Observations where certain claims were found unsearchable (Continuation of Item 2 of first sheet)**

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple Inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-15

Claims 1-15 define special technical features relating to a discoidal valve member controlling the flow of gaseous fuel from a fuel injector in an internal combustion engine.

2. claims: 16-20

Claims 16-20 define special technical features relating to the injection orifice size and shape of a fuel injector of gaseous fuel for an internal combustion engine.
Although claims 16-20 are dependent on claim 1, claim 1 is not new, and therefore the application lacks unity *a posteriori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/003727

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5924674	A	20-07-1999	DE BR CN WO DE EP JP US	19523915 A1 9606453 A 1157030 A ,B 9702433 A1 59610001 D1 0778924 A1 10505403 T 6131880 A	02-01-1997 23-12-1997 13-08-1997 23-01-1997 30-01-2003 18-06-1997 26-05-1998 17-10-2000
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JP 01249960	A	05-10-1989	JP	2584276 B2	26-02-1997
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EP 1231378	A	14-08-2002	US EP	2003111559 A1 1231378 A2	19-06-2003 14-08-2002
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US 4156506	A	29-05-1979	GB DE ES FR IT JP	1599525 A 2812739 A1 468271 A1 2384956 A1 1093613 B 53120017 A	07-10-1981 28-09-1978 16-09-1979 20-10-1978 19-07-1985 20-10-1978
EP 0491404	A	24-06-1992	JP JP EP US	2518031 Y2 4089853 U 0491404 A1 5178332 A	20-11-1996 05-08-1992 24-06-1992 12-01-1993
EP 1114929	A	11-07-2001	FR EP	2803362 A1 1114929 A1	06-07-2001 11-07-2001
US 6311901	B1	06-11-2001	AU EP EP EP EP JP WO WO WO WO US US US	4665000 A 1175558 A1 1175559 A1 1175560 A1 1173672 A1 2002543330 T 0065225 A1 0065226 A1 0065227 A1 0065228 A1 6334434 B1 2002050536 A1 2002030124 A1	10-11-2000 30-01-2002 30-01-2002 30-01-2002 23-01-2002 17-12-2002 02-11-2000 02-11-2000 02-11-2000 02-11-2000 01-01-2002 02-05-2002 14-03-2002

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/003727

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 5685485	A	11-11-1997	DE	4409848 A1		19-10-1995
			DE	59505999 D1		01-07-1999
			EP	0681873 A1		15-11-1995
			JP	7256155 A		09-10-1995
US 2002074431	A1	20-06-2002		NONE		
EP 1398497	A	17-03-2004	JP	2004060519 A		26-02-2004
			JP	2004060521 A		26-02-2004
			JP	2004068788 A		04-03-2004
			EP	1398497 A2		17-03-2004
			US	2004069873 A1		15-04-2004
US 6422198	B1	23-07-2002		NONE		
US 2002030124	A1	14-03-2002	US	2002050536 A1		02-05-2002
			AU	4665000 A		10-11-2000
			EP	1175558 A1		30-01-2002
			EP	1175559 A1		30-01-2002
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			JP	2002543330 T		17-12-2002
			WO	0065225 A1		02-11-2000
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			JP	2004156583 A		03-06-2004

PATENT COOPERATION TREATY

PCT

REC'D 16 FEB 2006

WIPO

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference G69147 ER.be	FOR FURTHER ACTION	
See Form PCT/IPEA/416		
International application No. PCT/EP2004/003727	International filing date (day/month/year) 07.04.2004	Priority date (day/month/year) 07.10.2003
International Patent Classification (IPC) or national classification and IPC F02M21/02		
Applicant MED S.P.A. et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input checked="" type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application 		
Date of submission of the demand 01.08.2005	Date of completion of this report 15.02.2006	
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Jackson, S Telephone No. +49 89 2399-7081	
 		

INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY

International application No.
PCT/EP2004/003727

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

2-7 as originally filed
1 received on 01.08.2005 with letter of 28.07.2005

Claims, Numbers

1-18 received on 01.08.2005 with letter of 28.07.2005

Drawings, Sheets

1/2, 2/2 as originally filed

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY

International application No.
PCT/EP2004/003727

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

the entire international application,

claims Nos. 14-18

because:

the said international application, or the said claims Nos. 14-18 relate to the following subject matter which does not require an international preliminary examination (specify):

see separate sheet

the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

no international search report has been established for the said claims Nos.

the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

has not been furnished

does not comply with the standard

the computer readable form

has not been furnished

does not comply with the standard

the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.

See separate sheet for further details

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/EP2004/003727

Box No. IV Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:
 - restricted the claims.
 - paid additional fees.
 - paid additional fees under protest.
 - neither restricted nor paid additional fees.
2. This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
 - complied with.
 - not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
 - all parts.
 - the parts relating to claims Nos. 1-13 .

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-13
Inventive step (IS)	Yes: Claims	
	No: Claims	1-13
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.
PCT/EP2004/003727

1 Reference is made to the following documents:

- D1: US-A-5 924 674 (FUCHS HEINZ ET AL) 20 July 1999 (1999-07-20)
- D2: EP-A-0 026 060 (LUCAS IND PLC) 1 April 1981 (1981-04-01)
- D3: PATENT ABSTRACTS OF JAPAN vol. 013, no. 593 (M-914), 27 December 1989 (1989-12-27) & JP 01 249960 A (JAPAN ELECTRON CONTROL SYST CO LTD), 5 October 1989 (1989-10-05)
- D4: WO 88/04727 A (LUCAS IND PLC) 30 June 1988 (1988-06-30)
- D5: WO 99/18345 A (CAMPBELL BILL ROSS ;GAS INJECTION TECHNOLOGIES PTY (AU)) 15 April 1999 (1999-04-15)
- D6: EP-A-1 231 378 (DELPHI TECH INC) 14 August 2002 (2002-08-14)
- D7: GB-A-2 178 483 (LUCAS IND PLC) 11 February 1987 (1987-02-11)
- D8: US-A-4 156 506 (LOCKE ALAN W ET AL) 29 May 1979 (1979-05-29)
- D9: EP-A-0 491 404 (JAPAN ELECTRONIC CONTROL SYST) 24 June 1992 (1992-06-24)
- D10: EP-A-1 114 929 (RENAULT) 11 July 2001 (2001-07-11)

Re Item III

2 The applicant has requested examination of the first invention only (claims 1-13), see Item IV below.

Re Item IV

3 The application does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

The subject-matter of independent claim 1 is already known (see section V below), so that the remaining claims can be analysed as to their technical contribution to the art. The requisite unity of invention (Rule 13.1 PCT) no longer exists inasmuch as a technical relationship involving one or more of the same or corresponding special technical features in the sense of Rule 13.2 PCT does not exist between the subject-matter of the following groups of dependent claims:

3.1 Claims 2-13, which define special technical features of a discoidal valve member for

a gaseous fuel injector.

- 3.2 Claims 14-18, which define special technical features of an injection orifice of a gaseous fuel injector.
- 3.3 It is obvious that a valve member, such as described in claims 2-13, does not need to be used in conjunction with an injection orifice, such as described in claims 14-18, and therefore, the two inventions are obviously independent from one another.
- 3.4 In conclusion, the groups of claims are not linked by common or corresponding special technical features and define two different inventions not linked by a single general inventive concept, hence the requirements of unity on invention are not met.

Re Item V

- 4 It should be noted that most forms of valve has the function of sealing a passage or opening, and automatically incorporates a sealing element with seals against a corresponding sealing element on the other body. It is quite common for one of these elements to be described of as a seat, although the function of such an element does not change, and a seat is also to be regarded as a sealing element.. The sealing element can be an integral part of the valve, or an additional body attached thereto. Either way, a sealing element exists, and all of the documents D1 to D10 disclose such a feature.
- 5 Document D1 discloses all the features of claim 1, including, with reference to figure 1, an electromagnetic actuator 3 acting on a discoidal member 20 arranged to open and close a passage from 32, through 14 and out of outlet 16, a sealing element 28 positioned between delivery conduit and discoidal member, whereby the sealing element 28 is fixed to the discoidal member 20 and moves with it (see paragraph 3 above).

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.
PCT/EP2004/003727

- 5.1 The documents D2 to D10 also disclose the features of claim 1, as can be seen in the relevant passages and figures cited in the search report.
- 5.2 Therefore, the present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.
- 6 Dependent claims 2-13 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty, as the subject matter of the claims is disclosed in the documents D2 to D10, as can be seen in the relevant cited passages and figures detailed in the search report.

1 IMPROVED ELECTRICALLY OPERATED INJECTOR FOR GASEOUS FUEL

The present invention relates to an electrically operated injector for feeding a gaseous fuel to a cylinder of an internal combustion engine, in accordance with the introduction to the main claim. *The preamble of the main claim refers to US 5926674 -*

An electrically operated injector of the aforesaid type is known to comprise a body connected to a feed conduit for the gaseous fuel or simply gas (such as liquefied petroleum gas, or such as natural gas or hydrogen); this body contains an electromagnetic actuator (electromagnetic coil) acting on a mechanical member or armature movable about a passage which connects a chamber of said body, in communication with the gas feed conduit, to a delivery conduit connected to an outlet for feeding the gas into the corresponding cylinder either directly or indirectly via the intake manifold of the internal combustion engine. Under the influence of the magnetic force generated by the electromagnetic actuator, this mechanical member shuts off or frees said passage in order to prevent or alternatively enable gas to be fed into the cylinder. The generation of this force is controlled by controlling the electrical feed to the actuator by means of a command and control unit for the internal combustion engine operation.

The mechanical member generally consists of a movable disc of ferromagnetic steel which closes the magnetic circuit generated by the actuator or coil.

In addition, between the mechanical member and the conduit delivering the gas to the nozzle there is a seal element which enables the delivery

CLAIMS

1. An electrically operated injector (1) for feeding a gaseous fuel to a cylinder of an internal combustion engine, in particular for a motor vehicle, comprising an electromagnetic actuator (2) acting on a discoidal mechanical interceptor member (3)

5 arranged to free or intercept a passage (4) for said fuel from a feed conduit (61) to a delivery conduit (5) connected to an outlet (6), a seal element (40) being positioned

between said delivery conduit (5) and said interceptor member (3), characterised in that
the seal element (40) is fixed to the interceptor member (3) and moves with it,

10 2. An electrically operated injector as claimed in claim 1, characterised in that the seal element (40) is fixed in a seat (50) provided in that face or first face (3B) of the interceptor member (3) which faces the delivery conduit (5).

15 3. An electrically operated injector as claimed in claim 2, characterised in that the seal element (40) is co-moulded with the seat (50) of the interceptor member (3).

4. An electrically operated injector as claimed in claim 1, characterised in that the seal element (40) presents a recess (44) in that end (42) thereof which cooperates with an end (43) of the delivery conduit (5) when the injector (1) is deactivated, said end (42) being annular, *and*

20 5. An electrically operated injector as claimed in claim 1, characterised in that the seal element (40) is of frusto-conical shape and rests with its tapered end (42) on the end (43) of the delivery conduit (5) when the injector is deactivated and the gas passage (4) is intercepted by the interceptor member (3).

25 6. An electrically operated injector as claimed in claim 5, characterised in that the wall (48) of the recess (44) or inner wall of the seal element (40)

has an inclination different from that of an outer wall (47) of said seal element (40).

5 1. An electrically operated injector as claimed in claim 2, characterised in that the seat (50) for the seal element (40) contains a projection (58) on which said element rests and of which it substantially copies the shape.

6 2. An electrically operated injector as claimed in claim 1, characterised in that the projection (58) presents an annular shape having an inner wall (49) and an outer wall (59), the inner wall (49) acting as a support for the seal element when urged into closure by the member which intercepts the 10 gas passage (4).

7 3. An electrically operated injector as claimed in claim 2, characterised in that the walls (49, 59) of the projection (58) have different inclinations to a common axis (M) which is perpendicular to that face (3A) of the interceptor member in which the seat (50) for the seal element is present.

15 8 4. An electrically operated injector as claimed in claim 2, characterised in that the seal element (40) projects from the first face (3B) of the interceptor member in which its seat (50) is provided.

9 5. An electrically operated injector as claimed in claim 1, characterised in that the interceptor member (3) presents, on that face or second face 20 (3A) distant from the first face (3B) carrying the seal element, a projecting part (35) jutting from said second face (A) and arranged to rest against the electromagnetic actuator (2) when the injector is open and the interceptor member (3) frees the gas passage (4), said member (3) being hence maintained at least partially detached from said actuator (1) when the 25 injector is open.

10 12. An electrically operated injector as claimed in claim 11,
characterised in that the projecting part (35) is annular. 10

11 13. An electrically operated injector as claimed in claim 12,
characterised in that the projecting part (35) is a part separate from the
5 interceptor member (3). 9

12 14. An electrically operated injector as claimed in claim 11,
characterised in that the second face (3A) of the interceptor member (3)
presents a seat (30) for an end (31) of a pin (24) partially inserted into an
inner cavity (13A) of a cylindrical part (13) of the electromagnetic actuator
10 (2), said pin maintaining the interceptor member (3) perpendicular to its
direction of movement relative to said actuator (2). 12

13 15. An electrically operated injector as claimed in claim 14,
characterised in that said pin is of wear-resistant plastic.

14 16. An electrically operated injector as claimed in claim 1, characterised
15 in that the delivery conduit (5) comprises a plurality of portions (5A, 5B,
5C), two of which have variable cross-sections along their axis (K).

15 17. An electrically operated injector as claimed in claim 16,
characterised in that a first portion (5A) of variable cross-section lies in
proximity to that end (43) of the conduit (5) which cooperates with the
20 interceptor member and has a cross-section which converges towards the
axis (K) in moving away from said end (43). 16

16 18. An electrically operated injector as claimed in claim 16,
characterised in that the second portion (5B) of variable cross-section
follows the first (5A) and diverges along the axis (K) in moving away from
25 said first portion. 14

¹⁷
19. An electrically operated injector as claimed in claim ¹⁶
characterised in that a hole for sizing the gas flow directed to the outlet (6)
is provided between said first portion (5A) and second portion (5B) of the
delivery conduit (5).
¹⁸
5 20. An electrically operated injector as claimed in claim ¹⁶
characterised in that a delivery conduit third portion (5C) lies between the
second portion (5B) and the outlet (6) and is of constant cross-section.